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Assessment of Declarative Metacognition

NEPS Starting Cohort 3 — Grade 5

*Paths Through Lower Secondary School —
Educational Pathways of Students in Grade 5
and Higher*

Wave 6 — Grade 9

Assessment of Declarative Metacognition

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Declarative Metacognition (Starting Cohort 3 – Ninth Grade)

A major goal of the National Educational Panel Study (NEPS) is the assessment of competencies that are considered to be of particular importance for educational pathways and participation in society. Longitudinal measurements of reading competence, listening comprehension, mathematical competence and scientific literacy have been and will be carried out coherently across the life span. These measurements are supplemented with regular assessments of metacompetencies such as abilities to handle information technologies (ICT) and metacognition (cf. Weinert, Artelt, Prenzel, Senkbeil, Ehmke, & Carstensen, 2011).

Metacognition is conceptualized as cognition about cognition (Flavell, 1979) and encompasses two components. On the one hand, the declarative knowledge component refers to the knowledge about memory, comprehension, and learning processes that an individual can verbalize. The procedural component, on the other hand, focuses on how the learning process is controlled and regulated through planning, monitoring, and metastrategic activities. The NEPS aims at assessing both, that is, declarative and procedural aspects of metacognition over the life span. In the following, the focus is placed on the assessment of declarative metacognition in Starting Cohort 3.

1. The Design of the Study

The description of the design of the study, the sample, as well as the instruments used can be found on the NEPS website[1]. Overall, 4,589 subjects participated in the test on metacognitive knowledge which was placed in second position after the test on reading competence. Testing time was 15 min.

2. The Assessment of Declarative Metacognition

The declarative aspect of metacognition is measured by scenario-based competence tests focusing primarily on different aspects of strategy knowledge (cf. Artelt, Beinicke, Schlagmüller, & Schneider, 2009; Schlagmüller & Schneider, 2007). The tests consist of several scenarios describing different school and leisure-time activities. Test scoring is done with reference to experts' judgments of the relative usefulness of the presented alternatives.

The test on declarative metacognition implemented in Grade 9, Starting Cohort 3, includes eight different scenarios. Three of the scenarios were taken from the test on declarative metacognition in Grade 6 (Starting Cohort 3) and Grade 9 (Starting Cohort 4).

The scenarios focus on conditional metacognitive knowledge, that is, knowledge about the appropriateness of different strategies in varying situations, and include cognitive, metacognitive, and resource management strategies (see Händel, Artelt & Weinert, 2013). Accordingly, the test assesses knowledge about solving cognitive tasks like remembering or organizing information, but also about general learning requirements. Six of the scenarios are

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[1] www.neps-data.de

related to a school or learning context, whereas the remaining two scenarios are embedded in out-of-school contexts, asking for domain-general strategy knowledge (see Table 1).

Table 1. Content of the Scenarios in the Domain of Declarative Metacognition

Scenario	Context	Strategies concerning
1	out-of-school context	remembering information
2	school context	reading, writing a summary
3	school context	general learning strategies
4	school context	strategies in the domain of mathematics
5	school context	monitoring, general learning strategies
6	school context	remembering information, organizing information
7	out-of-school context	information search, information evaluation
8	school context	reading, elaboration strategies

For each scenario, six strategies of differing quality are presented (see example, Figure 1). Subjects are asked to rate the usefulness of each strategy on a 4-point scale of usefulness (1 = *not at all useful*, 4 = *very useful*).

To score the test, pair comparisons (option X is more or less useful than option Y) are made with reference to experts' judgments of the relative usefulness of the presented strategies.

To establish validity for the test on metacognitive knowledge, scientists in the field of educational psychology and learning strategies were asked to provide their judgments on the appropriateness of each strategy. The expert ratings served to develop an objectified scoring procedure for the students' responses. Based on those expert ratings, the relation between all potential pairs of strategies within a scenario was evaluated. For each strategy pair the percentage of expert agreement was computed favoring one strategy as superior over another (pair comparison). If for an individual pair-wise comparison at least 75% of the experts agreed that one strategy was superior to the other strategy within the same pair, the pair comparison was considered valid for the assessment of students' metacognitive knowledge. To evaluate students' performance, their responses were recorded into dichotomous response categories based on the expert ratings.

Peter has a lot to do this week: He is supposed to go to the swimming club twice, he has been given plenty of homework, and he has to buy a birthday present for his friend.

What should he do in order to manage everything?

Please judge the usefulness of the proposed strategies.

	not useful at all	barely useful	somewhat useful	very useful
He makes a plan for the week and organizes his time for the tasks. He follows his plan very closely.	☐	☐	☐	☐
He combines different tasks and buys the birthday present on his way to the swimming club.	☐	☐	☐	☐
He allows others to help him. He asks his brother to buy the birthday present.	☐	☐	☐	☐
He completes only those pieces of homework which can be done quickly. Then he deals with the other things.	☐	☐	☐	☐
First, he buys the birthday present. If this takes too long, he will skip the homework or the swimming.	☐	☐	☐	☐
He does exactly what he feels like doing at this moment.	☐	☐	☐	☐

Figure 1: Example of a scenario in the domain declarative metacognition. Please note that this example was not included in the test on declarative metacognition in Grade 9.

3. Data in the Scientific Use File

The data set contains 69 valid pair comparisons. These pair comparisons are scored as dichotomous variables with 1 indicating a correct response (judgment on a strategy pair in line with the experts' ratings) and 0 indicating an incorrect response (judgment on a strategy pair contrary to the expert ratings or the two strategies of a pair were considered as equal).

The following example demonstrates the composition of the variable names for the pair comparisons.

md	g9	01	12	_c
declarative metacognition	grade 9	scenario 1	pair comparison of the strategies 1 and 2	scored variable

Three of the scenarios were already administered in Grade 9 in Starting Cohort 4 and Grade 6 in Starting Cohort 3. The items (i.e., pair comparisons) pertaining to these scenarios are marked by an additional suffix ("_sc3g9_"). The suffix that points to the repeated use consists of two parts: The first element indicates the starting cohort of current item administration (sc3 for the Starting Cohort 3) and the second element indicates the testing wave (g9 for Grade 9). The word stem of the variable name is fixed and does not change when the item was used again in later waves or other cohorts.

Table 2 shows the mean scores, standard deviation, and item-total correlations for the 69 pair comparisons.

Table 2. Descriptive Statistics of Pair Comparisons in the Domain of Declarative Metacognition

Scenario	Pair Comparison	Variable	*m*	SD	r_{it}
1	scenario 1: pair comparison 1	mdg90112_sc3g9_c	.75	.43	.40
	scenario 1: pair comparison 2	mdg90113_sc3g9_c	.43	.50	.22
	scenario 1: pair comparison 3	mdg90115_sc3g9_c	.65	.48	.37
	scenario 1: pair comparison 4	mdg90116_sc3g9_c	.92	.27	.44
	scenario 1: pair comparison 5	mdg90123_sc3g9_c	.65	.48	.21
	scenario 1: pair comparison 6	mdg90124_sc3g9_c	.56	.50	.30
	scenario 1: pair comparison 7	mdg90126_sc3g9_c	.84	.37	.23
	scenario 1: pair comparison 8	mdg90136_sc3g9_c	.92	.27	.39
	scenario 1: pair comparison 9	mdg90145_sc3g9_c	.50	.50	.30
	scenario 1: pair comparison 10	mdg90146_sc3g9_c	.85	.36	.38
	scenario 1: pair comparison 11	mdg90156_sc3g9_c	.89	.32	.26
2	scenario 2: pair comparison 1	mdg91212_c	.87	.33	.36
	scenario 2: pair comparison 2	mdg91214_c	.68	.47	.22
	scenario 2: pair comparison 3	mdg91215_c	.88	.33	.42
	scenario 2: pair comparison 4	mdg91216_c	.92	.27	.38
	scenario 2: pair comparison 5	mdg91223_c	.51	.50	.17
	scenario 2: pair comparison 6	mdg91235_c	.59	.49	.26
	scenario 2: pair comparison 7	mdg91236_c	.70	.46	.23
	scenario 2: pair comparison 8	mdg91245_c	.68	.47	.20
3	scenario 3: pair comparison 1	mdg91312_c	.89	.31	.39
	scenario 3: pair comparison 2	mdg91314_c	.74	.44	.40
	scenario 3: pair comparison 3	mdg91315_c	.92	.27	.40
	scenario 3: pair comparison 4	mdg91323_c	.77	.42	.18
	scenario 3: pair comparison 5	mdg91326_c	.86	.35	.35
	scenario 3: pair comparison 6	mdg91334_c	.62	.49	.24
	scenario 3: pair comparison 7	mdg91335_c	.84	.37	.23
	scenario 3: pair comparison 8	mdg91346_c	.74	.44	.38
	scenario 3: pair comparison 9	mdg91356_c	.93	.26	.38
4	scenario 4: pair comparison 1	mdg91413_c	.64	.48	.39
	scenario 4: pair comparison 2	mdg91416_c	.61	.49	.38
	scenario 4: pair comparison 3	mdg91423_c	.75	.44	.35
	scenario 4: pair comparison 4	mdg91426_c	.70	.46	.37
	scenario 4: pair comparison 5	mdg91434_c	.73	.45	.39
	scenario 4: pair comparison 6	mdg91435_c	.59	.49	.28

	scenario 4: pair comparison 7	mdg91446_c	.68	.47	.38
	scenario 4: pair comparison 8	mdg91456_c	.59	.49	.30
5	scenario 5: pair comparison 1	mdg91512_c	.85	.36	.35
	scenario 5: pair comparison 2	mdg91513_c	.77	.42	.32
	scenario 5: pair comparison 3	mdg91514_c	.70	.46	.25
	scenario 5: pair comparison 4	mdg91525_c	.68	.47	.31
	scenario 5: pair comparison 5	mdg91526_c	.61	.49	.17
	scenario 5: pair comparison 6	mdg91535_c	.59	.49	.25
	scenario 5: pair comparison 7	mdg91545_c	.53	.50	.17
6	scenario 6: pair comparison 1	mdg90613_sc3g9_c	.55	.50	.32
	scenario 6: pair comparison 2	mdg90616_sc3g9_c	.85	.36	.24
	scenario 6: pair comparison 3	mdg90623_sc3g9_c	.40	.49	.22
	scenario 6: pair comparison 4	mdg90624_sc3g9_c	.65	.48	.26
	scenario 6: pair comparison 5*	mdg90625_c	.90	.31	.34
	scenario 6: pair comparison 6*	mdg90626_c	.91	.28	.37
	scenario 6: pair comparison 7	mdg90634_sc3g9_c	.70	.46	.43
	scenario 6: pair comparison 8	mdg90635_sc3g9_c	.89	.32	.43
	scenario 6: pair comparison 9	mdg90636_sc3g9_c	.90	.30	.42
7	scenario 7: pair comparison 1	mdg90713_sc3g9_c	.88	.33	.46
	scenario 7: pair comparison 2	mdg90714_sc3g9_c	.55	.50	.27
	scenario 7: pair comparison 3	mdg90716_sc3g9_c	.79	.41	.30
	scenario 7: pair comparison 4	mdg90723_sc3g9_c	.90	.30	.37
	scenario 7: pair comparison 5	mdg90734_sc3g9_c	.81	.39	.24
	scenario 7: pair comparison 6	mdg90735_sc3g9_c	.93	.25	.41
	scenario 7: pair comparison 7	mdg90745_sc3g9_c	.68	.47	.24
	scenario 7: pair comparison 8	mdg90756_sc3g9_c	.84	.37	.22
8	scenario 8: pair comparison 1	mdg91812_c	.58	.49	.25
	scenario 8: pair comparison 2	mdg91815_c	.67	.47	.31
	scenario 8: pair comparison 3	mdg91816_c	.78	.41	.38
	scenario 8: pair comparison 4	mdg91823_c	.56	.50	.22
	scenario 8: pair comparison 5	mdg91824_c	.49	.50	.21
	scenario 8: pair comparison 6	mdg91835_c	.65	.48	.34
	scenario 8: pair comparison 7	mdg91836_c	.77	.42	.35
	scenario 8: pair comparison 8	mdg91845_c	.62	.49	.28
	scenario 8: pair comparison 9	mdg91846_c	.72	.45	.34
Scale	Cronbach's α = .89 N = 4,178				

*Please note the pair comparisons "mdg90625_c" and "mdg90626_c" were not reported in the data set referring to the test in Grade 6, Starting 3 and Grade 9, Starting Cohort 4. The user is asked to decide for him-/herself whether it might be reasonable to exclude these pair comparisons when the results of this test are related to the tests in Grade 6, Starting 3 and/or Grade 9, Starting Cohort 4.

As can be seen in Table 1, the internal consistency (Cronbach's α) of the test instrument is .89 (cases with missing pair comparisons were excluded for this analysis).

In addition to the pair comparisons, an overall mean test score is reported, including all pair comparisons with equal weight. The values of the mean test score range from 0 (no pair comparisons solved correctly) to 1 (all pair comparisons solved correctly).

The mean test score is 0.72 (*SD* = 0.15) for the investigated sample. The mean scores for the eight single scenarios range from *M* = 0.65 (*SD* = 0.29) to *M* = 0.80 (*SD* = 0.22).

There are different kinds of missing responses in the data set. These are a) nonvalid responses (for example, due to ticking two response categories on the 4-point scale), missing responses b) due to omitted items, c) due to items that are not reached, d) due to items that are not administered, and e) missing responses that are not determinable.

The coding of the missing responses in the pair comparisons is as follows: If just one kind of missing response in a pair comparison occurred, the corresponding pair comparison was labeled according to the missing response that occurred in the ratings of the single strategies. If different kinds of missing responses occurred in a pair comparison, the response was labeled as not determinable missing response. Overall, 91.0% of the participants show no missing response in the pair comparisons.

References

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